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ABSTRACT

This report summarizes a three-year project to design a graduate level course in ethics and scientific research at Dartmouth College (New Hampshire). The goals of the project were: (1) to train faculty to teach a course in research ethics, (2) to pilot-teach a graduate course in ethics and scientific research, and (3) to develop teaching materials for use in ethics and science courses. An underlying assumption was that a course in research ethics required both philosophers and scientists; therefore, faculty from both disciplines worked closely together in developing course materials. Faculty training included: a seminar, in which participants learned about various cases and topics in research ethics and tested various teaching styles; a study group, which helped participants gain an understanding of the theoretical bases for analyses of ethics cases; and meetings during which faculty worked on developing course goals, materials, and evaluation materials. Three publications resulting from the project are appended: (1) "Developing a Course on the Ethics of Scientific Research: A Guidebook for Faculty," which includes course goals and plans and a course reading list, (2) a table of contents for "A Coursebook for Research Ethics," and (3) "Ethical Issues in Scientific Research: Evaluation of Faculty Development" (Ronald M. Green). (CH)

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ED 415 773

Curriculum and Faculty Development for the Teaching of Academic Research Ethics

Project Summary

Grantee Organization:

Trustees of Dartmouth College
Office of Grants and Contracts
6210 Raven House
Hanover, NH 03755

Grant Number: P116B2087

Project Dates:

Starting Date: September 1, 1992
Ending Date: December 31, 1995

Number of months: 40 months
(includes 4-month no-cost extension)

Project Director(s):

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FIPSE Program Officer: Cari Foreman

Grant Award:

Year 1	$70,823
Year 2	$75,039
Year 3	$82,914
Total:	$228,776

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Curriculum and Faculty Development for the Teaching of Academic Research Ethics

Project Summary

This three year project had the goal of designing and pilot teaching a graduate level course in Ethics and Scientific Research. The underlying assumption of the grant was that a course in research ethics requires the expertise of both philosophers and scientists. Faculty from these two disciplines worked closely together to develop the skills and teaching materials necessary for the course. Faculty development centered on teaching the scientists the discipline of ethics and enabling philosophers to gain an understanding of scientific methodology and conventions. The course was taught twice. The second year was more successful than the first which reflected the learning curve of the faculty who needed time to gain an understanding of the case teaching methods which were central to a successful course. As a result of the project the co-directors are publishing two books, a monograph on developing a course in research ethics, and a companion coursebook to be used by students in research ethics courses. Extensive work on the grant was also done in evaluating the success of the teaching of the course. The co-directors are publishing a paper on their experiences and methodologies in evaluating the teaching of ethics.

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Titles of project reports and products:

- Developing a Course on the Ethics of Scientific Research: A Guidebook for Faculty. In Press, University Press of New England. 1996.
- A Coursebook for Research Ethics. In Press, University Press of New England. 1996.
- Elliott, Deni and Stern, Judy E. "Evaluating Students' Learning of Academic Research Ethics." Submitted, *Science and Engineering Ethics Journal*. 1995.
- Ethical Issues In Scientific Research: Evaluation of Faculty Development.

Curriculum and Faculty Development for the Teaching of Academic Research Ethics

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Executive Summary

A. Project Overview

The overall goal of the project was to develop a course and teaching materials on the topic of research ethics. Interest in this field has been growing as a result of a number of factors including both federal mandates and a few, recent, high profile cases of scientific misconduct. As a result of the grant we were able train faculty to teach a course in research ethics. We developed and implemented the course which included developing course goals, accumulating materials and implementing a course structure. Our work with the course led to a number of important insights into course development, faculty development and course evaluation. Our experiences led us to produce a monograph describing our course, our philosophy of teaching research ethics and the difficulties we encountered. This will be published as a faculty teaching guide. Student resources were collected and the material was incorporated into a student reader which also includes original work developed on this project and in a companion NSF grant. Extensive work on evaluating the teaching of ethics has lead to a paper on evaluating ethics teaching and to an application for future funding in this area.

B. Purpose

Cases of misconduct which have appeared in the popular press have tarnished the once pristine face of the scientific community. Concerns about such cases and about the apparent failure of traditional mentoring relationships in science for teaching ethics to students, have lead to increased interest in more formal ethics education. The federal government has in fact mandated formalized ethics education for some grant recipients. The increased interest in science education has left the scientific community in a quandary about how best to teach research ethics and by whom it should be taught. The purpose of this grant was to apply the expertise available at Dartmouth to this problem.

In developing the Dartmouth project we had several major goals. These were 1) to train faculty to teach a course in research ethics, including developing the abilities of science faculty in the teaching of ethics and instructing philosophy faculty in practices within the field of scientific research, 2) to pilot teach a graduate course in ethics and scientific research, 3) to develop teaching materials for use in ethics and science courses, and 4) to disseminate those materials for future use.

The strength of the proposal included the site at which the work was to be done. Dartmouth has an active Institute for Applied and Professional Ethics as well as a strong science faculty in many disciplines including basic science, medical sciences and engineering.

C. Background and Origins

The strength of the Dartmouth is in applied ethics and members of the Ethics Institute had extensive experience in the application of ethics to a number of fields prior to the onset of this grant. Bernard Gert a central faculty member in the project has developed a comprehensive ethical theory which he has applied over many years to a number of fields, most notably the field of medicine. At the time of the development of the grant Professor Gert was working on an NIH panel to define misconduct in science. Deni Elliott then director of the Dartmouth Ethics Institute also had experience in applied ethics in the fields of journalism and fundraising in higher education.

Science faculty from the College of Arts and Sciences at Dartmouth College and the Dartmouth Medical School also participated in the project. The project goals called for extensive work on the part of the team faculty in learning the methods of ethics case analysis and case teaching. The planned interaction was strengthened by the close association of the different schools at Dartmouth's rural campus.

D. Project Description

The project included extensive faculty training in three forms, a University Seminar, a Moral Theory Study Group, and Core Group meetings.

Project faculty participated in a University Seminar. The seminar was essentially a faculty study group facilitated by members of the teaching team. It enabled participants to learn about the various cases and topics in research ethics and to try out teaching styles. As described in the teaching monograph which we produced this faculty discussion was essential to train faculty in the issues and to enable them to gain perspectives on the cases. We recommend preliminary faculty seminars for anyone planning to undertake a course in research ethics.

The Moral Theory study group, under the direction of Professor Gert, was important to enabling the course faculty to gain an understanding of the theoretical bases for the analysis of ethics cases. This type of training proved invaluable when the faculty actually taught the course. Students gained from the abilities of the faculty to relate complex cases to clear and concrete moral principles.

At Core Group meetings faculty worked on course goals and compiled the materials that they felt were of most importance to the course itself. At these meetings there was also a good deal of work on developing evaluation materials that were subsequently used to evaluate the course.

Teaching of the course was more successful on the second attempt than the first. The faculty learned important lessons about how to apply what they had learned the first time around. They also learned from failures in evaluation tools.

E. Evaluation

Evaluation of the student course was performed with the help of two instruments. The first of these was a Learning Environment Preferences Test coupled with a Perceptions of Learning Environment test. The second tool was a pretest posttest instrument.

The Learning Preferences and the Perceptions tests were less effective than hoped. Although they provided some information on the students' learning styles this was not significantly better than using a standard course evaluation form.

The pretest posttest instrument was more effective in measuring student learning, particularly when we modified the test in the second year into a meta-analysis. This meta-analysis method involved having students review their own responses from the start of the term. The evaluation enabled the test to be used both as an evaluation method and as a learning tool.

Additional evaluation of the project as a whole was performed by an outside observer who interviewed faculty and observed University Seminar sessions. This evaluation yielded the conclusion that the faculty had made significant gains in analytical abilities and attitude toward ethics teaching during the duration of the project.

F. Summary and Conclusions

The project yielded significant work in three areas. The first area included gaining an understanding of what is needed to train faculty including the skills that must be developed in order to teach a successful research ethics course. This work resulted in the production for publication of a faculty teaching guide. The second area of significant achievement was in the development of the course itself. This area led to course goals which are to be included in the published teaching guide. It also yielded a manuscript which will be published as a student reader. The reader includes original articles from contributors as well as cases and materials collected for use in the course. It includes information on regulations as well as real cases of misconduct for class discussion. The final significant result of the grant was preliminary development of the meta-analysis pretest posttest case analysis method. This method has been described in the teaching guide and in an original paper by the project co-directors. It is being developed as a pre-proposal submitted to FIPSE for future funding.

Curriculum and Faculty Development for the Teaching of Academic Research Ethics

FINAL REPORT

A. Project Overview

Our initial grant application stated the following :

> "Interest in research ethics by scientists, engineers, and philosophers has been growing rapidly, in part due to increasing Federal attention to this area. NIH and NSF, for example, both now require ethics education as components of their training grants. Specialized accrediting groups, such as the American Association for the Accreditation of Laboratory Animal Care (AAALAC) and the Accreditation Board for Engineering and Technology, Inc. (ABET), now require ethics training for investigators as well" (Project grant submitted to FIPSE 1992).

Interest in research ethics has continued to grow since this statement was written. Although the federal mandate to teach research ethics is still important today the numbers of materials for the teaching of research ethics has not changed substantially. Materials that we have developed in the course of this funded project include course curriculum, a teacher's manual and student reader which are substantive materials for use in this area.

B. Purpose

The Dartmouth project was developed with the realization that there is a dearth of teaching materials and methods for the field of scientific research ethics. The project drew upon the strengths of the Dartmouth community in which there was an established and strong Institute of Applied and Professional Ethics as well as

a strong science faculty in the school of Arts and Sciences and in the Dartmouth Medical School and the Thayer School of Engineering.

The original grant application stated 4 major goals:

1)"Through model teaching and peer-seminars, teach science faculty to recognize and analyze the ethical issues that arise in academic research."
2) "Team-teach an interdisciplinary seminar in academic research ethics for graduate students in science with the twin goals of piloting a course to be offered on a continuing basis by the College and testing materials and techniques that can be incorporated as individual units into other college courses".
3) In conjunction with a companion grant from NSF, "develop teaching modules (80-125 manuscript pages) for graduate students of science that include article reprints, cases, analyses, as well as relevant Federal guidelines and statements of professional standards for at least three of the following areas: research methodology, professional honesty, reporting on research, whistle blowing and loyalty, human experimentation, and animal experimentation."
4) "Disseminate materials and articles discussing faculty development and pedagogical techniques to a national audience of scholars and teachers of research ethics" (Project grant submitted to FIPSE 1992).

C. Background and Origins

The Ethics Institute at Dartmouth College was especially well-suited to develop and implement a project in the teaching of Ethics and Research to graduate students. As stated in the application "The College has a decade-long tradition of interdisciplinary work in applied and professional ethics and the Ethics Institute is known nationally for its innovative work in applied and professional ethics."

The project built upon the conceptual leadership of philosopher Bernard Gert. Gert had applied his comprehensive moral system to a number of problems in applied ethics in a variety of disciplines. At the time that this project was begun professors Gert and the Dartmouth Ethics Institute had just initiated a University Seminar in Research Ethics. This seminar was further developed and proved central to the grant.

D. Project Description

Our project required that we train faculty to teach a course in research ethics. It required that we develop the course curriculum and that we institute and teach the course.

As discussed in our monograph on the teaching of research ethics (see Appendix I) faculty development for our project had several parts to it.

> "Before we taught a course for graduate students, we had to learn the field of research ethics ourselves. We then had to develop our skills as teachers of this field. The learning process that we engaged in took several forms: we sought out and studied the cases and case material in the field; we spent time ensuring that the scientists gained an understanding of ethical theory and that the philosophers gained an understanding of scientific practices, and we developed our abilities in applying ethical theory to cases in research ethics. This work was done within the University Seminar series ..., within a Moral Theory Study Group, and within a series of meetings of the faculty teaching team called Core Group Meetings. The final development of the faculty as teachers of research ethics came through teaching the graduate course itself" (Appendix I).

A central feature of the development of the course was development of the course goals. As stated in our monograph this use of goals is not as familiar to scientists as it may be to ethics teachers:

> "Because the use of goals may be unfamiliar to may scientists (as they were to the scientists on our team) it deserves some explanation. Scientists are, for the most part, used to teaching in a lecture format. This is because in science courses we are presenting information based on data and statistics with the aim of increasing a student's body of knowledge. In ethics teaching... we are teaching a process, a way of thinking through a problem, and are less concerned with teaching a body of knowledge. Making use of course goals is therefore essential. This is because teaching through case analysis involves far more than simply presenting the case and waiting for the students to say something about it. A successful discussion leader must center the discussion around a set of goals as the case unfolds. At the end of the class session a successful discussion leader will have related the case to each of the goals and drawn the students into analysis on a number of points related to the goals. In this way discussion of the case will have proceeded, not as a random and fruitless exercise, but rather, as a forum for instruction in the issues of central importance to the course. Teaching through case analysis requires a great deal of time, attention, and planning. Crucial to teaching via case discussion is identification of the goals for each session" (Appendix I).

The overall goals of the research ethics course read as follows:

"We are offering this course in the hopes that students will:
1) be able to clearly describe relevant scientific conventions including laboratory practice, institutional responsibility, etc.;
2) be able to describe what leads to ethical problems including causes inherent in the social context of the practice of science;
3) be able to consider how to bring current scientific conventions more in line with the ideal;
4) be able to separate behaviors into four categories: morally prohibited, required, permitted, and encouraged , thus illustrating an understanding of the role of the scientist in society" (Appendix I).

The teaching monograph developed as a result of this project outlines goals for each of the topic sections as well.

E. Evaluation

There were two parts to the evaluation of this project. The first part was the evaluation of the course itself, the second was an overall project and faculty development evaluation.

1. Evaluation of the course

In our monograph on the teaching of research ethics we observed that

> "Creation of an adequate learning environment is central to the teaching of ethics. The learning environment refers to the emotional and intellectual climate in which the students are expected to learn ethics. We found that it was important to evaluate how much students are encouraged to take the kind of intellectual risk necessary to express their beliefs and to try on new ways of looking at an issue.
>
> Many of us, in the first year of teaching the course, fell into the familiar trap of sharing information rather than facilitating learning. In our eagerness to share understandings and information with the student, we forgot that student learning in the ethics classroom, like the lab, is dependent upon student *practice* with all of its fumbling and failures" (Appendix I).

We used two different methods to evaluate the success of the course. The first

> "tool that we attempted to use to measure the learning environment was developed by William Moore from the Center for the Study of Intellectual Development. In a pre course instrument we asked the students questions that allowed us to assess their learning style preferences. In a post course instrument we measured the students' perceptions of how well the

environment fit their needs with regard to abstraction, personal relationships (personalism), structure, and diversity. Our experience with this test have been outlined by us elsewhere.[1] In summary, time costs for the tests (one hour each to complete the pre- and post-test) left us unpersuaded about the worth of this test" (Appendix I).

The second tool that we used for evaluation was a pretest post test.

"After two years of teaching the course and of trying out the vehicle in other settings[2], we have concluded that a pre-test/post-test evaluation vehicle works if the following criteria are met: students are motivated to take the vehicle seriously; the special perspective of students in the lab is taken into account in deciding the content for analysis, and; students are asked to perform a meta-analysis at the end of the term rather than simply re-analyzing the case that they considered at the beginning of the term. Meta-analysis involves asking the students to consider the inadequacy their own previous analysis of the case" (Appendix I).

2. Evaluation of the project

An overall evaluation of the project and the faculty development component of the project was performed by Ronald Green. Green used tools including interview of faculty, faculty questionnaires and observation. His conclusions are summarized in his report.

"On balance, it appears that, at least for the teaching faculty involved, the result of this project was to help them develop considerable sophistication

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1 Elliott, Deni and Stern, Judy E. Evaluating Students' Learning of Academic Research Ethics; submitted to *Science and Engineering Ethics Journal.* 1995.

2 One of us (DE) used and continues to use a pre-test/post-test vehicle as described here in her teaching of an introductory level ethics course, as well as an upper level seminar in ethics and public affairs, and in graduate level seminars on special topics in ethics at the University of Montana. Our experiences with this tool are being developed for publication, see note 1.

about the issues of scientific research ethics and the challenges of teaching in this area. At the close of the project, the ethicists and scientists involved as core teachers had arrived at substantial agreement about the way that science research ethics education should be structured and conducted. Surprisingly, they were also in far more agreement about the need for education in this area than were many of their students and their non-involved science colleagues" (Appendix III).

F. Summary and Conclusions

The faculty had a number of successes as well as some difficulties in the process of developing a course in research ethics for graduate students. The successes included development of an excellent course and collation of key teaching resources and materials which are soon to be published. The difficulties came in the area of faculty training. These initial difficulties however were translated into the final success of the course in that faculty from science and philosophy learned a great deal about each other's disciplines.

With regard to the original goals of the grant we 1) taught science faculty to analyze ethics cases, 2) team taught a seminar course in research ethics which can continue at Dartmouth, 3) developed materials in conjunction with a companion NSF grant, 4) developed plans to disseminate materials in the form of a published faculty guide which describes the outcomes of the grant funded activities as well as an accompanying coursebook for students.

Curriculum and Faculty Development for the Teaching of Academic Research Ethics

Appendix

I. Developing a Course on the Ethics of Scientific Research: A Guidebook for Faculty

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Evaluation of Faculty Development. By Ronald M. Green

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Developing a Course on the Ethics of Scientific Research:

A Guidebook for Faculty

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A Series of Teaching Resources
In Applied and Professional Ethics

Volume I.

The Institute for the Study of Applied and Professional Ethics at Dartmouth College
Hanover, New Hampshire

Forward

In 1992, a team of philosophers and scientists at Dartmouth College and Dartmouth Medical School received a grant from the Fund for the Improvement of Post Secondary Education (FIPSE) to develop a graduate level course in Research Ethics. This project spanned three years and included a dedicated team of individuals including Dartmouth Professors Edward M. Berger, Albert Bradley Third Century Professor of Biology; Marilyn Brown, Director, Animal Care and Use Program; Bernard Gert, Eunice and Julian Cohen Professor of Ethics and Human Values in the Department of Philosophy; Allan U. Munck, Third Century Professor of Physiology; and Judy E. Stern, Director of the Human Embryology Laboratory in the Department of Obstetrics and Gynecology; from the Department of Veteran's Affairs, Karen Lomax, Co-Director, National Center for Clinical Ethics; and Deni Elliott who moved from the Directorship of the Dartmouth Ethics Institute during the tenure of the project to become Mansfield Professor of Ethics in Public Affairs at the University of Montana. The present monograph describes the graduate course in research ethics that was developed by this team during the period of this grant, and presents a compilation of our course materials and bibliography in research ethics. We convey some of our successes, concerns, and our difficulties in teaching research ethics to graduate students with the hope that others can learn from our experiences as they develop similar courses.

It was essential to us in developing a course in research ethics, to define why research ethics should be taught. Many scientists think that the teaching of ethics is the teaching of right and wrong. Since they believe that the ability to make ethical decisions is either innate or learned early in life, they conclude that instruction in ethics is a waste of time. Our belief is that while innate abilities may work to solve simple problems, complex problems are often compounded by "gut reaction" and

"fly by the seat of the pants" approaches that arise from ordinary unstructured analysis. It was the intention of this team to construct a course that would bring a systematic approach to the evaluation of ethical problems in science. Our hope was to enable scientists to deal with complex problems before they become complex nightmares. Our reasons for doing this are related in Section 1 of the monograph. In Section 2 we approach the questions of who might benefit from the study of research ethics, and of what value such a course might be. We also make some recommendations on curriculum design and course structure for different audiences.

The value of teaching an ethics course from a specific set of interrelated goals is described in Section 3. This section relates the goals that we developed for our course and gives a picture of the way in which we structured our class sessions. We develop our perspective on the manner in which the goals work together to advise the teaching.

In preparing the course, the faculty team felt it necessary to gain both familiarity with the topic of research ethics and an expertise in case analysis and ethical theory. In the fourth section we describe our struggle to gain expertise in these areas. And a struggle it was. The faculty team worked long and hard to develop an understanding of the strengths and weakness in the fields of ethics and science. This odyssey is well worth relating as it was ultimately of immense value to the course to have a faculty who had experience in both disciplines.

The question of what we were teaching when teaching ethics advised the manner in which we measured what we taught. In the fifth section we come to grips with what we actually taught to graduate students. We believe that our first attempt at teaching the course was a partial failure: faculty did not follow the goals set, students were not properly introduced to ethical theory, and evaluation tools were

not adequate for measuring our progress. In this section we discuss our difficulties in evaluating what we set out to do.

Teaching research ethics requires institutional support and faculty participation. In our concluding remarks we describe our experiences and frustrations in bringing research ethics to the graduate school curriculum.

The final sections of the monograph include materials which we hope will be of assistance to others in compiling their own courses. Included as Section 7 is the reading list we used in our course in research ethics. Some of the materials we used worked better than others and we discuss a few of our favorites in the Notes on the Bibliography and Videography. The Bibliography and Videography contain a wide range of material including cases, analytic articles, and videos appropriate for teaching.

A companion piece to this monograph is a student reader entitled "A Coursebook for Research Ethics." The Coursebook was developed with the help of the FIPSE grant and an additional grant from the National Science Foundation (NSF). This companion grant had the goal of developing written teaching materials in research ethics. The NSF grant pulled together a consortium of philosophers and scientists from 5 different institutions including Acadia Institute, Dartmouth College, Illinois Institute of Technology, Loyala University, Massachusetts Institute of Technology, and the University of Montana. The student reader which we have developed includes original articles by both the NSF consortium members and members of the Dartmouth teaching team. Longer, more in depth versions of the NSF consortium articles have been published in the *Professional Ethics Journal* vol. **X(need to fill in)**..Reprinted readings from the Dartmouth course and case scenarios on each topic round out the selection of teaching materials in the Coursebook. The topic areas covered in the Coursebook include those stressed by the Dartmouth team and those, which in addition, were considered important by the NSF consortium

members. The reader provides a wealth of background information and case material for use in ethics classes.

No project is completed without the help of many minds and hands. We wish to give special thanks to all of the members of our faculty team for their invaluable contributions, for their time and energy, and for 3 years of continued growth and development. Special thanks as well to the members of the NSF consortium for their assistance and support in putting together the companion student reader. We would like to thank Barbara Hillinger for her unflagging energy in keeping our team focused on the tasks at hand, and for her excellent management of the project budget. We thank Julie Wright for her administrative help and for her assistance in tracking down materials. Thanks to Ken Clemmer, a Dartmouth undergraduate, for his thorough and careful work on the bibliography and to Pat Blandford, a graduate student in philosophy at the University of Montana, who collected materials and previewed hours of video tapes to create the videography. Thanks to Aarne Vesilind of Duke University for his gracious help with the Engineering Bibliography. Special thanks go to Ron Green, present Director of the Dartmouth Ethics Institute, for his continued enthusiastic support of this project. Finally we would like to thank the Fund for the Improvement of Post Secondary Education without who's support this project would not have been possible.

Section 1
Why Teach Research Ethics?

Recently, one of us (JES) had the opportunity to speak with a medical student about a research rotation that the student was planning to do. She would be working with Dr. Z, who had given her the project of writing a paper for which he had designed the protocol, collected the data, and compiled the results. The student was to do a literature search and write the first draft of the manuscript. For this she would become first author on the final publication. When concerns were raised about the proposed project, Dr. Z was shocked. "I thought I was doing her a favor" he said innocently, "and besides, I hate writing!"

Dr. Z is perhaps a bit naive. Certainly, most researchers would know that the student's work would not merit first authorship. They would know that "gift" authorship is not an acceptable research practice. However, an earlier experience in our work makes us wonder. Several years ago, in conjunction with the grant from the Fund for the Improvement of Post Secondary Education (FIPSE) a team of philosophers and scientists at Dartmouth College ran a University Seminar series for faculty on the topic "Ethical Issues in Scientific Research". At one seminar, a senior researcher (let's call him Professor R) argued a similar position to that of Dr. Z. In this case Professor R knew that "gift" authorship, authorship without a significant research contribution, was an unacceptable research practice. However, he had a reason to give authorship to his student. The student had worked for several years on a project suggested by him and the project had yielded no publishable data. Believing that he had a duty to the student to ensure a publication, Professor R had given the student some data that he himself had collected and told the student to write it up. The student had worked hard he said, albeit on another

project, and the student would do the writing. Thus, he reasoned, the authorship was not a "gift".

These two stories point up a major reason for encouraging courses in research ethics: good intentions do not necessarily result in ethical decisions. Both of the faculty members in the above scenarios "meant well". In both cases, the faculty members truly *believed* that what they were doing was morally acceptable. In the first case, Dr. Z's (indefensible) error was that he was unaware of the conventions of the field. In particular he seemed blissfully oblivious to the meaning of first authorship. In the second case, Professor R was doing what he thought best for the student without taking into consideration that morality is a public system and that his actions with regard to a single student have public consequences for the practice of science as a profession.

Well meaning scientists, such as those above, can, with the best of intentions, make unethical decisions. In some cases, such decisions may lead individuals to become embroiled in cases of misconduct. A course in research ethics can help such scientists to appreciate that it is their responsibility to know professional conventions as well as to understand the public nature of morality.

There are scientists for whom a course in research ethics will be less useful. Efraim Racker,[1] in a 1989 article describes a student in his lab who was a "professional" fabricator of data. This student composed lab books without performing experiments, added radioactive material to gels to produce bands where he wished those bands to be, and lied to his colleagues about his actions. Another researcher, Elias Alsabti, described by D. J. Miller[2], was a meticulous plagiarizer. This

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1 Racker, E. "A view of misconduct in science." *Nature* 339(May 11):91-93.1989.

2 Miller, D. J. "Plagiarism: The case of Elias A.K. Alsabti" In Research Fraud in the Behavioral and Biomedical Sciences. Chapter 5. Miller, D. J. and Hersen, M. (eds.). John Wiley & Sons, Inc. New York. 1992.

physician-researcher, fabricated his CV, copied a colleague's grant for his own use, published other people's data under his own name, and co-authored his pilfered data with fictitious collaborators. Individuals such as these are unlikely to learn research ethics through instruction because they are not interested in becoming ethical practitioners.

The ethics of scientific research is somewhat unique within professional ethics in the sense that good science requires the ethical practice of science (this will be discussed in more detail in Section 4). Nevertheless, a course in research ethics cannot and should not have as its central focus the question "Why *should* I be moral?" This question, while important, is not specific to the field of scientific research. A course in research ethics, as envisioned by the Dartmouth team, must be a course which teaches the tools for making ethical decisions relative to matters of research. It will be designed for those scientists who are already committed to being ethical researchers. Such a course should provide students the answers to the question "How *can* I make moral decisions?"

Although it is the fabricators and the plagiarizers who we most often think of when we think of research misconduct, these are not the only people accused of misconduct. They are also not the only people who are guilty of misconduct. Many other scientists have had lives and careers affected by misconduct cases.

It is undoubtedly unfair to generalize from a few cases of misconduct to an entire profession. Nevertheless, reported cases of misconduct are not uncommon and this could reflect a failure to train students to the highest ethical standards. The 1993 Office of Research Integrity (ORI) publication reported the 1991-1992 caseload to include 29 institutional inquiries, 21 institutional investigations, and 7 ORI inquiries or investigations[3]. The 1995 ORI publication reported the 1994 case load as

[3]US Department of Health & Human Services. *Office of Research Integrity Biennual Report 1991-92.* Public Health Service. Rockville, MD. (September). 1993.

13 institutional inquiries, 17 institutional investigations, and 8 ORI inquiries or investigations[4]. Of actions closed in these years (55 in 1991-1992; 44 in 1994), some involved fabrication, some falsification, some plagiarism, and others some combinations of fabrication, falsification, plagiarism and "other misconduct". Slightly less than half of the investigated cases closed as of these reports were found to involve misconduct and resulted in sanction of the accused party. The academic rank of the accused ranged from technician to full professor. Cases were reported from a number of institutions and the accused parties were funded by a variety of funding sources

Cases of misconduct are not simple matters to evaluate. One source of concern is confusion within the field of science about just what constitutes a punishable infringement of ethical standards. In the fields of engineering, law, and medicine, clear written guidelines exist for defining ethical conduct. Although some particularly difficult cases may test the limits of these guidelines, most do not. In scientific research, a written code of conduct is not available[5]. The federal government[6] and individual institutions[7] have been struggling to clarify the standards under which misconduct can be adjudicated. The central definitions which delineate misconduct in science include fabrication, falsification and plagiarism. However, these are confused by other less clear categories of misconduct

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[4]US Department of Health & Human Services. *Office of Research Integrity Annual Report 1994*. Public Health Service. Rockville, MD. (April). 1995.

[5] Gorlin, R. A.(ed.). Codes of Professional Responsibility. Third edition. BNA Books. Washington, DC. 1994. The 1994 edition contains codes of conduct for groups ranging from the American Institute of CPA's and the National Association of Realtors to the American Nurses Association and the American League of Lobbyists, but has no codes of conduct for scientists or scientific research.

[6] Panel on Scientific Responsibility and the Conduct of Science. Responsible Science: Ensuring the Integrity of Scientific Responsibility and the Conduct of Research. Volume I (1992) and Volume II (1993). National Academy Press. Washington DC.

[7] Dartmouth College Policy and Procedures for Safeguarding Integrity in Research, Training, and Other Related Activities. Council on Sponsored Activities. Revised, September, 1995.

which include "other questionable behavior" or "other misconduct." Within this confusion of definitions it is not always obvious to students or faculty where and toward whom their obligations lie.

Complicating the confusion generated by the way in which we define research misconduct, is the teaching process by which students routinely learn about the ethical obligations of their profession. Traditionally a scientist trains with a single mentor. From this mentoring relationship the graduate student is expected to learn about scientific method, the body of knowledge that constitutes the specific field of science she is studying, and the "institution" of science. What is learned about the institution of science includes knowledge of the mechanics of obtaining funding, information on the writing of grants and papers and an understanding of the roles and responsibilities for maintaining and sharing research data. As part of her instruction in all of these areas, it is assumed that she will also learn the ethics of scientific research.

In the case of the story of Dr. Z above, it is clear that Dr. Z's relationship with his mentor did not result in his having learned a basic convention of the field. So, it is not surprising that Dr. Z was prepared to pass his unrecognized confusion to a student who was working with him. Mentoring relationships within science education do not necessarily result in adequate familiarity with the ethics of research.

Judith Swazey of the Acadia Institute has studied this issue and presents some very distressing data on the efficacy of mentoring relationships in graduate education[8]. Although 89% of 2,000 graduate student respondents from 98

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[8] Swazey, J. P. "Teaching research ethics: needs opportunities, and barriers in graduate programs." Background paper for Meeting of NSF Consortium Project: The Production of Educational Modules for the Teaching of Research Ethics. Lake Bluff, IL. April 2-4, 1993. Published versions of some of these data include: Swazey, J. P, Louis, KS., and Anderson, MS. "The Ethical Training of Graduate Students Requires Serious and Continuing Attention." *Chronicle of Higher Education*, 9(March): B1-2. 1994; Swazey, J. P. "Ethical Problems in Academic Research." *American Scientist*. 81(Nov./Dec.):542-53. 1993.

departments of major research institutions said that they related to a single faculty member who was particularly supportive of their work, less than 45% of students felt that this faculty member gave them "A lot" of help toward teaching them the details of good research practice. 15-20% of the students felt that the help they got in this area was "None". Fewer than 45% of students believed that they got "A lot" of helpful criticism on a regular basis[9]. In the majority of cases, students felt that their faculty support person did not provide the type of mentoring relationship that one would hope for in the ethics training of a research scientist.

When Swazey asked students to compare the role that a department *should take* in preparing students to recognize and deal with ethical issues in their field to the role *actually taken* by the department, her results were equally disturbing. Eighty-two percent of students felt the department should take an "Active" or "Very Active" role in this process, while only 22% felt that an active or very active role was actually taken[10].

The perceptions of faculty were not much different from those of the students. Ninety-nine percent of 2,000 faculty members surveyed felt that "academics should exercise collective responsibility for the professional conduct of their graduate students"; only 27% of these faculty felt that they followed through with this responsibility[11].

These data provide evidence to indicate that individual mentoring is a less than adequate teaching method for ethics. If the majority of students do not receive mentoring that leaves them with a clear understanding of their responsibilities as

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[9]Students had the choices of "A lot", "Some" and "None".

[10]Ibid., 1993a, page 6-7.

[11]Ibid., 1994, page B-2.

scientists, then cases of unintentional misconduct and questionable practice are inevitable.

The role and importance of ethics education has begun to be recognized by the NIH. Guidelines for NIH research training grants now require a minimal number of hours of ethics education[12]. Ethics need not be taught within a single graduate course, but it is beginning to be recognized that education in the basic conventions of the field and in the basic approaches to ethical decision making can no longer be left to one-on-one mentoring alone. As the ever dwindling availability of research funds fuels the fire of competition, there will be increased pressure on scientists to bend or break rules. Research laboratories, particularly large groups where some students rarely see their faculty advisors, can not be assumed to teach research ethics, or even to train students in all research conventions.

Whether scientific ethics is approached through a single course or a series of courses or seminars throughout the graduate curriculum, it has become obvious that students need exposure to ethics in a number of contexts. Research ethics can and must be taught in a formalized manner. It is our belief that courses in research ethics that incorporate a solid philosophical framework have the greatest potential for long term usefulness to students. While other methodologies may reinforce this material, a course of the type described in this monograph has the potential to help a student develop the tools to see ethical problems from a new vantage point. It is in this context and for these reasons that we designed our course in research ethics.

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[12]National Institutes of Health and Alcohol, Drug Abuse, and Mental Health Administration. "Reminder and Update: Requirement for Instruction in the Responsible Conduct of Research in National Research Service Award institutional Training Grants." NIH Guide for Grants and Contracts. 21(43):2-3. 1992.

Section 2
Who Needs Research Ethics?

In answer to the question "Who needs research ethics?" many of us might answer, "I don't need it, but that guy over there certainly does." The situations related in Section 1 indicate that at least some "of those guys over there" could profit from an opportunity to discuss ethical problems that arise during their research.

The vast majority of scientists doing research have had no formal training in research ethics. If Judith Swazey's data are correct, students have been poorly mentored in research ethics, and faculty who were trained by the same methods may themselves be lacking an ethics education. Conventional wisdom which may or may not be handed down from mentor to student probably differs widely from laboratory to laboratory. Scientists generally operate under the faulty assumption that everyone agrees about what constitutes reasonable conduct.

During our faculty University Seminar in Research Ethics we found that nearly every issue engendered lively debate. Nearly every point discussed became a point of contention. As an exercise at one of the University Seminars, we had participants evaluate a series of case vignettes. Scenarios included funding, collaboration, publication, sexual relationships between mentors and students, fabrication, and maintaining lab notebooks. The responses made clear that there was little agreement between scientists on some fundamental issues. There was no agreement, for example, on who should keep lab notebooks and on how long they should be kept. There was little agreement on who should be first author on a paper from a collaborative project. Faculty differed widely on perceived appropriateness of student-mentor sexual relationships and on what constituted an appropriate response to reports of data fabrication.

In the course of this 3-year project, we have come to believe that when we ask the question, "Who needs research ethics?" our answer must be, "practicing scientists". All scientists engaged in research can benefit from the discussion of research ethics. This doesn't mean that the study of ethics will answer questions about how long to keep a lab notebook or who should be first author on a paper. Ethics education is not about finding a "correct" answer. Nevertheless, discussion of ethical issues allows scientists to grapple with and develop strategies for recognizing, approaching, and resolving ethical problems.

The value one places on training in research ethics may be proportional to what one feels can and should be accomplished through ethics education. As already addressed in Section 1, we do not believe that ethics education should have the goal of teaching someone why they should be moral. University Seminars, courses in ethics and other forums for ethics debate serve a function only for those scientists who already wish to be ethical researchers. For such scientists the discussions in such forums allow them to evaluate conventions, define responsibilities, articulate positions on different issues, and acquire some facility at using a framework for ethical decision making.

Discussion of conventions has merit even when different scientists cannot agree on what a particular convention should be. For example, discussion can lead to effective strategies for avoiding conflict. In the case of laboratory notebooks, one can ensure that a clear policy on who keeps notebooks is articulated before the research is undertaken. Similarly, in the case of first authorship, discussion of authorship before a project is undertaken can be encouraged. In the first case scenario in Section 1, Dr. Z would have benefited from a discussion of conventions. Gaining the knowledge that there are written guidelines for authorship in most journals would in itself have been helpful to him.

Conventions may differ significantly from one field of science to another. The order of authorship in one field may reflect the level of involvement in the experimental protocols while in another field it may reflect an alphabetical listing. Practices for replication of experiments may also differ. Large population-based psychology experiments may not be expected to be repeated prior to publication while assay results of a physiology experiment may be expected to be repeated several times. Though conventions themselves may differ, certain consistent themes can be clarified by these interactions. For example, no matter what the research practice is regarding replication in a particular field, it is ethically unacceptable for scientists to lie about what they are doing. If they report that they are showing a "representative experiment" when they only did the experiment once, they are misrepresenting the experiment. An additional advantage to discussion of conventions is that they help to delineate expectations within a particular field. They also aid in alleviating confusion when scientists from one field collaborate with those of another field.

It is also important that scientists discuss their responsibilities vis a vis colleagues, students, and professional institutions. There is a good deal of conflict and confusion among graduate students about what they can and should expect from their mentors. There is probably also some confusion on the part of mentors as to what they can and should ask from their students. Responsibilities for sharing information, for ensuring honesty of one's co-authors, and for pursuing accusations of whistleblowing are often at issue for professionals. Which responsibilities should be shouldered by the institution and which by the individual researcher are valuable to discuss. Professor R from the second case scenario in Section 1 did benefit from discussion of responsibilities. It was clear from the comments around the table in the University Seminar that few of his colleagues agreed, as he had assumed, that he had a responsibility to ensure that his student be an author on a

publication. And few believed, as he thought, that his behavior was an example of moral excellence. He didn't promise to change his practice, but he did promise to think more about it.

One aspect of responsibility that is important to note is that all scientists have some responsibility for their actions. The tool that we used to evaluate student learning the first time we ran our graduate course pointed out to us that many students responded as though students in the test scenarios were victims who had little or no responsibility for their own actions. The students analyzed a case in which a postdoctoral fellow had misrepresented his data on a published graph. The students were able to identify the part played in the misadventure by a failure of responsibility on the part of the faculty advisor and the journal editors. Few held the postdoc primarily responsible for the misrepresentation, a point which had seemed clear to the faculty members who chose the case for analysis. The students preferred to blame shoddy training and poor mentoring for the postdoc's misdeed. Each person in a laboratory, on a publication, and at a research institution has responsibilities to maintain the ethical integrity of the field and it is important that these responsibilities be discussed and acknowledged by all practitioners in the lab: faculty, students, and technicians.

Examples of conventions and responsibilities point up a central advantage to discussions of ethics and research among scientists. Discussions of ethics force individuals to verbalize their positions on the issues. Verbalizing one's position removes the opportunity for the sort of excuse used by Dr. Z in the first scenario in Section 1. Had Dr. Z been provided a forum to verbalize the fact that knowing the conventions of the field is central to making ethical decisions, then it would have been much more difficult for him to have claimed ignorance of such conventions. Allowing one's positions to remain unstated makes it far easier to overlook obvious flaws in one's own arguments.

Finally, ethics education can enable scientists to place their positions into a logical framework from which they can look for consistent approaches to related problems. In this sense it was the perspective of the Dartmouth team that the involvement of philosophers in both course design and teaching of research ethics is central to development of a course in this discipline. In contrast to the dismissive approached taken by some scientists, we believe that philosophers are essential in assisting scientists to define a realistic, rational ethical framework from which to view ethical problems. Just as a scientist would not try to develop a project in a related but different scientific field without collaboration with an expert in that scientific field, so developing a course is ethics without the benefit of ethicists is a naive endeavor.

Moral problems are not isolated from one another and solutions to ethical problems in science cannot run counter to solutions to ethical problems outside of science. It cannot be moral for a scientist to deceive or to break a promise without justification any more than it is moral for a physician, an auto mechanic, or a secretary to do so. Because morality is a public system, our solutions to one problem have implications for others. Morality is a public system in that it is, at its fundamental level, a series of generally understood but rarely spoken rules about how we act in relation to one another. When Professor R in scenario 2 decided to give first authorship to his student, this decision had implications for all first authors. First authorship cannot mean both that an individual has *had* primary responsibility for conceiving of, developing, and performing a set of experiments and that this individual has *not had* this responsibility. Exceptions to the rule must themselves be publicly explicit to be moral.

Just as philosophy has been central to medical, engineering, and legal ethics it is central to research ethics. A study of moral theory can help scientists to identify moral problems and differentiate these from legal, social, and economic problems.

An approach centered in philosophical tradition will also help scientists clarify the value of making their positions and their arguments explicit. It will expose inconsistencies in the scientist's approach in dealing with ethical matters. On a problem-by-problem basis, a philosophical approach can assist scientists in separating actions which are morally neutral, thus morally permitted, from those which involve responsibilities and are thus morally required, from those that are unacceptable, thus morally prohibited. Moral theory need not be learned in great detail, and it is not necessary to learn about the variety of moral theories that have become accepted as the "standard" theories, What is necessary is learning to approach moral problems in a systematic way.

We designed our graduate course with an eye toward those topics that we felt would provide the best foundation in ethical decision making. We began by reviewing the topics covered during two years of our University Seminar and from these we chose those topics that we felt would be of the greatest value in conveying conventions and responsibilities to students at an early stage in their careers.

The content areas covered in the University Seminar included: methodology, reporting research, professional honesty, research relationships and communication, institutional responses, conflict of interest, journalism and science, human and animal experimentation, and objectivity in science. From these we chose to concentrate in the graduate course on topics of immediate importance "at the bench": methodology, reporting research, institutional responsibility, peer review, and human experimentation, and animal experimentation. We also included a session on interpersonal interactions in the lab. Issues of social responsibility, including such topics as "journalism and science" and "objectivity in science" were set aside.

Although the original target audience for our course was graduate students in biomedical sciences we drew students from psychology, engineering, chemistry and

earth science. Students in different disciplines had different levels of interest for different topic areas. Students in psychology wanted more concentration on human experimentation, those in engineering wanted less. Students in engineering wanted more attention paid to business and commercial complications faced by scientists, those in psychology for the most part did not. Courses can be designed to focus greater or lesser attention on different content areas to serve different target audiences. Nevertheless, we do believe that a survey of certain major and essential content areas is an important part of each scientist's education. We see our course as a survey course that had the function of beginning the process of ethics education.

The disagreement between students from different disciplines about what ought to receive primary attention in the course was offset by the value of students coming to understand how conventions among scientific disciplines differ. While we initiated the faculty seminar to develop a teaching team and to practice thinking together about these issues, we discovered in the process of running both a University Seminar and a graduate course that the faculty were often more engaged in discussion of these issues than were the students. For this we credit the role of experience. Faculty with years of research behind them had endless stories and mishaps to relate. Some faculty also found themselves defending actions which students dismissed offhand as morally prohibited. Students tended to be somewhat idealistic and unrealistic about the pressures and the temptations to which they might someday succumb. As we will discuss in Section 4, we believe that faculty seminars are central training grounds for faculty involvement in ethics education.

It should not be forgotten that faculty can also learn from students. In discussions with Professor R, none of the faculty identified the responsibilities of the student to whom the gift authorship was given. When we brought this same case to a group of students, one said that he would not accept authorship in this case

because he would not want to assume responsibility for data he had not collected himself.

The course that we developed was targeted for graduate students but we feel that it could be used with some modifications for researchers at all stages of their careers. Because ethics education involves the development of complex skills more than the incorporation of empirical information, the study of ethics and its practical applications can and should be a process that continues throughout one's career. The course that we outline in the next section can only begin this process.

Section 3
A Course in Research Ethics

Our course in scientific research ethics had a seminar format in which class sessions were built around analysis of real and hypothetical cases. As described in the previous section, our overall goal for the course was to assist students in bringing a systematic methodology to ethical problems. We expected students to develop an understanding of what it means to work at ethical problems in a systematic fashion. Our approach to teaching was, therefore, to use structured discussion of cases as the central feature of class sessions.

Students met for a single two-hour session once a week during a 9 week term. Each class session focused on a specific topic area. The course was team taught with each class session lead by one faculty discussion leader. Several members of our faculty teaching team were present at all times to answer questions and engage in discussion with students.[13] The course director was present for all sessions to provide continuity. An essential component to team teaching in this manner was for course faculty to spend considerable time working together on issues of research ethics, a process which will be described in the next section.

Students were assigned readings in advance of each class session to help them become familiar with regulations, conventions, and responsibilities within the topic areas. We expected students to use this information in discussion when they came to class. Although we began by thinking that some formal lectures would be helpful for students, we changed our minds after weighing the result of both the students' comments and our own assessment of what the students had learned the first time

[13] The availability of faculty for attendance at numerous class sessions was a luxury afforded us by the fact that the course was taught under grant funding. Even a team taught course will not always have this luxury without such funding. In this case we would recommend that a single course director be available for every session and that the total number of faculty not exceed 3.

we offered the course. Our experience leads us to be skeptical of using valuable class time for the presentation of material that the students can incorporate through readings. We do, however, believe in creating class discussions that require students to draw upon this information whenever possible. What we found was similar to what has been suggested by other teachers of ethics: that passive learning, simply listening to lectures, does not adequately equip students to use their own judgment in analyzing real life situations.[14]

We recommend that the first session of the class be used to present a framework for dealing with ethical problems. The first time we offered the course, we did not have such a session. This was partly because we were concerned that science students would be turned off by a blunt discussion of ethics. We hoped instead that students would recognize the ethical theory *behind* our discussion of the cases. This did not work. The students did not adequately develop a systematic approach to ethics. The second time we offered the course, we presented a session on ethical framework at the start, and we were able to relate all further discussion back to the material presented in the first session: this was a far more successful approach.

Real cases, documented in newspaper and other articles, were an important source of course materials. We believe that real cases bring a depth and reality to the discussions. We thus began our course with the discussion of a real and very complex case, the Immanishi-Kari/Baltimore case. In addition, we used a combination of case scenarios and literature to focus on issues which could less easily be deciphered from the real life situations. The play *A Stampede of Zebras* by R. G. Martin, for example, was very important in helping us present the topic of interpersonal interaction in the laboratory.

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14 E.P. Learned. "Reflections of a Case Method Teacher." in *Teaching and the Case Method.* Christensen, C. R. 87:9-15. Harvard Business School. 1981.

As cases highlight what has gone wrong, we were concerned that the use of case material might leave students with a negative view of the field they are entering. But, in our experience, students appreciated the use of case material, particularly when cases were well chosen so that the situations were familiar and believable. Rather than making students uncomfortable with their chosen field, the use of cases reassured them that they were not alone with, and unusual in, concerns that they themselves had recognized or confronted.

To reinforce the case analysis method, we included one session for student presentations. During this session students presented and analyzed cases of interest to them. We believe that student presentations are a central component to an ethics course. Although we had the students do these analyses through verbal presentations we would have preferred to also include written presentations. In fact, we feel that written assignments on a weekly basis would be optimal. Such a course structure would require, however, that a course in research ethics have more institutional support than we were able to muster. Since, as we describe in Section 6, recruitment of students was a problem for us, we intentionally kept the course requirements to a minimum.

What follows is a presentation of the course format and goals for our course in research ethics. Because the use of goals may be unfamiliar to may scientists (as they were to the scientists on our team) it deserves some explanation. Scientists are, for the most part, used to teaching in a lecture format. This is because in science courses we are presenting information based on data and statistics with the aim of increasing a student's body of knowledge. In ethics teaching, as described in previous sections, we are teaching a process, a way of thinking through a problem, and are less concerned with teaching a body of knowledge. Making use of course goals is therefore essential. This is because teaching through case analysis involves far more than simply presenting the case and waiting for the students to say

something about it. A successful discussion leader must center the discussion around a set of goals as the case unfolds. At the end of the class session a successful discussion leader will have related the case to each of the goals and drawn the students into analysis on a number of points related to the goals. In this way discussion of the case will have proceeded, not as a random and fruitless exercise, but rather, as a forum for instruction in the issues of central importance to the course. Teaching through case analysis requires a great deal of time, attention, and planning. Crucial to teaching via case discussion is identification of the goals for each session.

Ethical Issues in Scientific Research

Course Goals and Plan

Course Format:

This team taught course will use a case based format. Instructors will plan presentations around cases (either real cases or case scenarios). The goal is to encourage students to participate actively in discussion of issues. Faculty presentations will be brief, no more than 10 minutes in length. The role of the faculty is to: present the complexities of the case; to briefly clarify relevant guidelines and regulations where appropriate, and; to relate the responses of the students to the moral rules and to the concepts of morally prohibited, required, permitted and encouraged behaviors.

Course Goals:

We are offering this course in the hopes that students will:

1) be able to clearly describe relevant scientific conventions including laboratory practice, institutional responsibility, etc.;

2) be able to describe what leads to ethical problems including causes inherent in the social context of the practice of science;

3) be able to consider how to bring current scientific conventions more in line with the ideal;

4) be able to separate behaviors into four categories: morally prohibited, required, permitted, and encouraged , thus illustrating an understanding of the role of the scientist in society.

Week #1: Ethics: A Framework For Dealing With Ethical Problems In Research

Format: The class will discuss the article "Moral Theory and Science"

Objectives *(students will be able to)*:

1) Understand basic concepts that underlie ordinary morality;

2) Understand that ordinary morality applies to scientific practice.

Week #2: Methodology and Reporting

Format: This class will be based on the Imanishi-Kari/Baltimore case. There will be a brief synopsis of the case followed by a case discussion. Specific issues related to methodology and reporting will be highlighted. Other aspects of the case will discussed if time permits.

Objectives *(students will be able to)*:

1) Describe how ethical behavior is entirely consistent with, and necessary for, good scientific methodology and reporting;
2) Explain what each of the following is and why they constitute scientific misconduct: falsification, fabrication, plagiarism;
3) Explain the scientific and ethical justification behind each of the following scientific conventions:
   a. Keep good notebooks
   b. Use statistics appropriately
   c. Repeat experiments until you are confident of the result
   d. Record and report your work accurately;
4) Explain the difference between hiding negative results and morally permitted omission of an experiment that doesn't work;
5) Explain what should be included in the "Methods" section of a paper. Articulate the ethical justification of why this material needs to be included;
6) Discuss the validity of the assumption that erroneous results will be "caught" through replication of the data in other laboratories;
7) Explain the importance of adequately citing previous work in the field.

Week #3: Interpersonal Relationships

Format: This class will be based on the play "A Stampede of Zebras." A brief discussion of the roles and responsibilities of laboratory personnel will be followed by discussion of the interpersonal issues raised in the play.

Objectives *(students will be able to)*:

1) Explain the relationship between lab hierarchy and the success of the work and between group dynamics and the success of the work;
2) Describe what constitutes judicious (permitted, encouraged, etc.) use of power within the lab structure and provide examples for how power can be used and misused;
3) Describe professional limits on non-professional relationships involving lab personnel;
4) Describe loyalties to mentors, other colleagues, and friends and explain how these can give rise to ethical problems;
5) Understand the way in which loyalties to colleagues and friends can lead to difficulties in regard to making appropriate ethical judgments.

Week #4: Practical Applications In Reporting, And Peer Review

Format: This session will involve discussions about a set of short case scenarios. The class will be divided into small groups for the initial discussions of the cases. Groups will be brought back together at the end to review and summarize the issues discussed in each group.

Objectives *(students will be able to)*:

1) Explain how ethical issues arise around conventions of authorship: for example, the order of listing of the authors and who to include (and exclude) as an author on a publication;
2) Explain the conflicts of interest that can arise from the peer review system;
3) Describe the responsibilities of reviewers of publications and grants;
4) Describe relative merits and failings of alternative systems of evaluation (i.e. non-peer review).

Week #5: Institutional Responsibility/the Whistleblower

Format: This class session will begin with a discussion of the difficulties encountered by whistleblowers. Using a hypothetical case scenario, students will develop their perspective on how they perceive an institution might best respond to accusations of misconduct. The second half of the class will rely on examples from cases which will explore the issues from the perspective of the institution.

Objectives *(students will be able to)*:

1) Explain institutional and governmental regulations (including bio-safety regulations) and policies (including policies on misconduct) relating to the practice of scientific research;
2) Provide examples of alternative methods of dealing with misconduct. (This should be done from the point of view of a student, PI, department head, or dean);
3) Describe the responsibilities of institutions in the ethics training of graduate students and postdocs;
4) Describe the responsibilities of the institution for enforcing institutional and governmental regulations;
5) Describe the relevant rules and regulations including institutional conflict of interest policy.

Week #6: Scientists' Relationships With Funding Sources

Format: In this class session students will deal with issues of conflict of interest in several different cases involving funding sources.

Objectives *(students will be able to)*:

1) Describe the obligations of students and faculty to funding sources (funding sources may include commercial, governmental, military etc.);
2) Describe the potential conflicts that can arise between obligations to funding agencies or employers and obligations to scientific integrity;
3) Differentiate between enthusiastic and exaggerated grant proposals;
4) Describe the relevant rules and regulations including institutional conflict of interest policy.

Week #7: Animal Research

Format: The class will begin with a discussion of the moral status of animals. The students will then be divided into small groups where they will review research proposals as though they were members of an Institutional Animal Care and Use Committee (IACUC). At the end of class the findings of each group will be reviewed by all.

Objectives *(students will be able to)*:

1) Explain the purpose of the relevant rules and regulations relating to the use of animals in research;
2) List the ethical concerns posed by the use of non-human animals;
3) Develop guidelines for evaluating the appropriateness of using animals in a research project;
4) Explain the role and responsibilities of the scientist and of the IACUC in the protection of research animals.

Week #8: Human Research

Format: Students will review two complex cases on human experimentation. Issues of responsibility of the investigators and the Institutional Review Board (IRB) will be discussed.

Objectives *(students will be able to)*:

1) Explain the purpose of the relevant rules and regulations relating to the use of human subjects in research;
2) List and explain the criteria of valid consent; understand the moral significance of obtaining valid consent;
3) Describe principles relevant to moving from basic experimental research into clinical trials (e.g. when is one ready to do this?);
4) Explain the role and responsibilities of the scientist and of the IRB in the protection of human subjects;
5) Understand the responsibilities of the PI, as well as clinical and non-clinical collaborators, for ensuring that obligations to IRB requirements are met.

Week #9: Student Presentations

Format: Students will work in groups to present a case or case scenario of interest to them. Their presentations will include defining the ethical issues raised by the case and evaluating the actions taken. Faculty will participate in the discussions and assist the students to understand aspects of the case which they may have missed.

Objectives:

To give the students an opportunity to use the skills developed during the term.

Section 4
Training Faculty to Teach Research Ethics

Before we taught a course for graduate students, we had to learn the field of research ethics ourselves. We then had to develop our skills as teachers of this field. The learning process that we engaged in took several forms: we sought out and studied the cases and case material in the field; we spent time ensuring that the scientists gained an understanding of ethical theory and that the philosophers gained an understanding of scientific practices, and we developed our abilities in applying ethical theory to cases in research ethics. This work was done within the University Seminar series discussed above, within a Moral Theory Study Group, and within a series of meetings of the faculty teaching team called Core Group Meetings. The final development of the faculty as teachers of research ethics came through teaching the graduate course itself.

The role of the University Seminar in faculty training was alluded to in Sections 1 and 2 above. The University Seminar was a testing ground for material. Cases were explored and discussed, issues were raised and evaluated, topic areas were sorted and reviewed. The University Seminar gave both faculty who were teachers in the course and who were simply interested in the subject (about 40 participants) a forum for discussion. It gave a wide range of faculty from different scientific disciplines a chance to express their opinions about cases and issues. An essential aspect of this forum for the course itself was that when material was presented in class in front of the students, faculty were not hearing it for the first time. In this way differences of opinion between faculty members were "hashed out" prior to class sessions. We strongly recommend that anyone planning a course in research ethics, particularly those planning to team teach, participate in a series of seminars or informal study groups prior to bringing the material to students.

The Moral Theory Study Group involved only the faculty teaching team (6 members). This study group began by dealing with ethical theory as an issue separate from the ethics of scientific research. Moral theory was then systematically applied to specific cases, simple ones at first, more complex ones later.

Core Group Meetings allowed us to bring in additional material which fit into neither of the above contexts. Ethicists learned more about the nature of bench research. All of us learned something about the history of science and the development of present day scientific conventions.

A central feature of all of our faculty training sessions was intense and emotional debate (some might call this argument). Some of this debate was in fun, some was soul searching, some was fiercely self protective, all was loud. Scientist-to-scientist, we actively debated the conventions of the field. The value of this for the subsequent course was that it allowed us to gain a thorough appreciation of the extent of the differences in conventions from one area of science to another. Scientist-to-ethicist we had our most intense, difficult, and possibly our most productive debates.

Talking about the ethics of any field is difficult. Ethics interferes with unbridled self interest and arrogated power. This is as true in the professions as it is in the kindergarten room, and possibly no less uncomfortable for adults than it is for children. Discomfort is as evident among scientists as it is anywhere else. As one member of the science faculty put it "It is harder than I thought to deal with issues of scientific integrity with scientists. They[15] tend to get defensive, feisty, and see ethics teaching as a peripheral activity."

It would be wrong to conclude that debates at these meetings took the form of ethicists trying to tell scientists how to do science (although we occasionally did

15 Given that this was said by a member of the science faculty, it is interesting that the individual said "they" rather than "we."

come close to this). Instead, the central feature of the debates was that they became learning experiences for all. One example of this can be found in an argument that developed over the topic of scientific methodology. Through a series of long and tortuous discussions spanning several years, our group struggled with the issues of how ethical theory applies to the scientific method itself. Through these discussions scientists learned to apply concepts of deception, cheating and the need to have adequate justification before engaging in such activities, to the practice of science. Philosophers learned about fundamental distinctions in scientific research, such as the difference between a failed experiment—one which yields no data, and an experiment which produces a negative result—a result which contradicts one's hypothesis. Through debate we came to what now seems an absurdly obvious conclusion that a central feature of good scientific method is the ethical practice of science. However we came to this conclusion with a heightened understanding on all sides of why this is so and why important features of both ethics and science make it so.

One reason for some of the tension between scientist and ethicist may have been the inherent conflict between the methods of science and the methods of ethics. According to one ethicist, scientists seem to have a "desperate hold on empiricism," a need to rely on objectivity, and falsifiability in ethical as well as in scientific problems. Scientists, for their part, felt that ethics questions could be answered simply by applying the methods of science, and that in this sense there was "no separate domain of ethics" within the field of scientific research. The methods of science and ethics are different enough that the scientific reliance on objectivity can lead to confusion. Solving an ethical problem does require that you discover the facts of the case (e.g. who did what to whom and when). But solving such problems cannot wait for verifiable data on whether or not a particular course of action will lead to a desired conclusion. Indeed, ethics problems often have at

their core the need for an immediate answer on an issue about which there is a central unknown. An example that relates back to the question of methodology is that the answer to whether or not a particular hypothesis is right or wrong cannot be a determining factor in whether or not a researcher includes or excludes a certain piece of data in a graph. The ethical determination on the use of that data must be made before we know (if we ever do) whether or not the hypothesis is correct. Some scientists will recognize that this particular example is also an example in which doing ethical science and doing good science coincide.

Learning to be teachers in this field proved to be a challenge above and beyond learning about the field of research ethics. After a year and a half of working together we offered our graduate course for the first time. Our plan in the first year was to present a small portion of the material in lecture format and to then move on to case analysis in the second half of each class session. We found the faculty resistance to this to be quite intense. Science faculty clung to the more familiar framework of lecturing the students. Cases were presented in lecture format. Regulations were laboriously described. "Discussions" were, in many instances, less discussions than presentations by sage scientists telling war stories and informing novices of how it *should* be. It was interesting that although we had worked together to use interactive approaches for a year and a half it was still difficult for each of us to shed the familiar role of lecturers and to take on the role of discussion leaders. What we found was a marked distinction between the development of the skills in ourselves and the use of those skills in our teaching.

In the second year we were more successful. With a bit more prodding and a clear message from the students that they too would prefer more discussion, we pushed ourselves to use the skills in case analysis that we had developed. We insisted that faculty plan their presentations *without* a defined lecture component.

We developed additional strategies, such as breaking into small groups, to ensure that we would not lapse into lectures.

Those of us who learned the ethics of scientific research as graduate students learning from a mentor or series of mentors did not have the opportunity to combine the skills of the scientist with the skills of the ethicist. When confronted with ethical problems, this leaves us searching for answers for each case as though it is isolated from all other cases. In this sense we have not been trained to teach a course in ethics to graduate students. The process which we undertook to develop our skills in this area was a difficult but a valuable one. We recommend it both for the benefit of the faculty and for that of the students they plan to teach.

Section 5
Evaluating the Success of an Ethics Course

The Dartmouth team found that showing we had accomplished what we set out to accomplish in the ethics course was far more difficult than we had expected. All professors and mentors learn to trust their "gut" in determining when students have "gotten it". And, in evaluating students' acquisition of a new piece of knowledge, the professor's instinct may be adequate, at least in the short run. But our ethics course focused on students learning concepts and a method for analysis rather than on pieces of information. It was only after teaching the course for two years that we felt that we had really learned how to adequately evaluate our student's success in the course.

Adequate evaluation of an ethics course depends on the faculty accomplishing the following: clear articulation of reasonable course objectives; creation of a learning environment in which achieving the course objectives is possible; practice for students throughout the term in achieving course objectives, and creation of a vehicle by which students can demonstrate mastery of course objectives.

This list of necessary conditions for adequate evaluation is true for every course, but deserves special attention in the teaching of ethics. While there are those scientists who doubt that ethics can be taught, there are even more skeptics in and out of science who doubt the ability to measure what one has accomplished in the ethics class.

We blame evaluative skepticism on the confusion in the field that comes about when one fails to distinguish between pedagogical hope and instructional objectives. One might hope that one's students become highly ethical practitioners

in their careers and become highly ethical people in their private and public lives as well. But, that is not an instructional objective.

A literature professor might hope that his students all become writers of fine literature and a science professor might hope that her students make significant advances in knowledge through their future work. These are the pedagogical hopes that one may have for one's students.

But whatever the pedagogical hope of the individual instructor, it is the instructional objective that provides quantifiable criteria for whether the instruction in a particular course has been successful or not. Instructional objectives articulate specifically what the instructor hopes to accomplish in the course. Whatever we might hope about the future ethics of our students, their moral righteousness is not a legitimate course goal. It is, therefore, not an instructional objective that can be adequately evaluated at the end of the term.

Our course goals, and the specific goals for each class that amplified course goals were presented in Section 3. These goals included objectives that we wished the students to achieve. The goals also implicitly detail the steps of moral analysis that we wished the students to learn. These steps in moral analysis include:

1. *Describe the action(s)* that raises an ethical question.
2. Determine whether the action conflicts with *relevant scientific conventions.*
3. Articulate any relevant *social or professional responsibilities* that the actor has in the situation.
4. Discuss what kinds of alternative actions would be *morally prohibited* and why they would not be acceptable.
5. Identify a series of alternative actions that would be *morally permitted* in the specific case and discuss why they would be acceptable.
6. Identify which actions would be *morally encouraged* in the specific case and discuss why certain actions are better than others.

The course goals or instructional objectives provide a basis for developing an instrument that allows students to show that they have learned new skills and have acquired a more sophisticated understanding of the profession. There is no better way to determine a lack of clarity in goals than by asking how you would test to see if students had achieved these goals.

Creation of an adequate learning environment is central to the teaching of ethics. The learning environment refers to the emotional and intellectual climate in which the students are expected to learn ethics. We found that it was important to evaluate how much students are encouraged to take the kind of intellectual risk necessary to express their beliefs and to try on new ways of looking at an issue.

Many of us, in the first year of teaching the course, fell into the familiar trap of sharing information rather than facilitating learning. In our eagerness to share understandings and information with the student, we forgot that student learning in the ethics classroom, like the lab, is dependent upon student *practice* with all of its fumbling and failures.

This lack of understanding of the learning process is particularly significant for no one on the team learned from being lectured to by their scientific or philosophical peers. We had forgotten the joyful arguments we had as we individually struggled to get clear on conventions, to decide what made a particular action right or not, and to become more consistent in our attempts to generalize from particular actions to standards for the scientific community.

Formalized surveys exist for determining the level of safety and challenge that students perceive in the classroom (Stone, H.; Moos, R.; Mitchell, R.[16]). But we

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16 Stone, H. "Preferred learning styles index." Personal communication. University of Wisconsin Medical School; Moos, R. and Insel, P. "Preliminary manual for the work environment scale." Consulting Psychologists Press. Pal Alto, CA. 1974; Mitchell, R. "The development of the cognitive behavior survey to assess medical students' learning." Paper presented at the Annual Meeting of the American Education Research Association. San Francisco, CA. April 22, 1992; Bibliography from Moore, G. T., Block, S., Briggs-Style, C. and Rudolph, M., "An Evaluation of the Impact of The New Pathway Curriculum on Harvard Medical Students." Personal communication.

found that this could be adequately determined informally by noting the students' willingness to participate in discussion and their willingness to challenge or question the beliefs expressed by the instructor. The traditional student evaluation form completed at the end of the class also makes clear, as it did to us in our first year, if the professor is using too much class time for "preaching" rather than teaching.

An additional tool that we attempted to use to measure the learning environment was developed by William Moore from the Center for the Study of Intellectual Development. In a pre course instrument we asked the students questions that allowed us to assess their learning style preferences. In a post course instrument we measured the students' perceptions of how well the environment fit their needs with regard to abstraction, personal relationships (personalism), structure, and diversity. Our experience with this test has been outlined by us elsewhere.[17] In summary, time costs for the tests (one hour each to complete the pre- and post-test) left us unpersuaded about the worth of this test.

We believe that student practice is of central importance in developing skill in moral analysis. Students can practice in a variety of ways: large group discussion, small group work on problems or scenarios, individual case write-ups or journals. In retrospect, we did a better job in the second year than in the first in providing opportunities, in every class session, for group discussion and work. However, because of colleagues' concern that the elective ethics course might take too much time and attention away from other graduate work, we felt unable to assign weekly writing assignments. We believe that the best way to give students practice in

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[17] Elliott, D. and Stern, J. E. "Evaluating Students' Learning of Academic Research Ethics." Submitted to *Science and Engineering Ethics Journal*. 1995.

analyzing ethical questions in science is to provide a combination of peer discussion and individual written analysis each week.

It seemed clear to us that the appropriate way to evaluate the students' ability to analyze moral problems in science was to give them such problems for analysis. A pre-test/post-test combination provided an opportunity for students to show new or greater understandings at the end of the term as compared with an analysis completed at the beginning of the term.

After two years of teaching the course and of trying out the vehicle in other settings[18], we have concluded that a pre-test/post-test evaluation vehicle works if the following criteria are met: students are motivated to take the vehicle seriously; the special perspective of students in the lab is taken into account in deciding the content for analysis, and; students are asked to perform a meta-analysis at the end of the term rather than simply re-analyzing the case that they considered at the beginning of the term. Meta-analysis involves asking the students to consider the inadequacy their own previous analysis of the case.

In the first year that we taught the course, students received the grade of "Pass" for attending the seminars and for completing the pre-test and post-test materials. This did not encourage them to take the writing assignment seriously. The faculty was extremely dissatisfied with the scoring and evaluation of student performance as determined by outside readers. At first, we wondered how the scoring could have been so inadequate. It was only after we had the pre-test and post-test essays coded and distributed among us that we realized that we could not tell on the basis of response which were pre-tests and which were post-tests. While we recognize a number of factors contributing to the students' poor performance

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18 One of us (DE) used and continues to use a pre-test/post-test vehicle as described here in her teaching of an introductory level ethics course, as well as an upper level seminar in ethics and public affairs, and in graduate level seminars on special topics in ethics at the University of Montana. Our experiences with this tool are being developed for publication (see note 14).

(such as our reliance on lecture), it was clear to us that the students completed the analyses hastily.

One of us (DE) has also found that students do a far more complete job of analysis, both early and late in the term, if the vehicle is given at the beginning and end of the term as a take-home rather than in-class assignment. The results are also far easier to read.

The content for the analysis is also important. In the first year, we chose a case[19] that we believed would engage the students. As two postdocs had participated in the reported misconduct in the case, we believed that the students would be able to see themselves in a similar situation, facing similar temptations. We expected their later, more sophisticated analysis, to go beyond the obvious problem of the postdocs' falsification and fabrication and that they would be able to identify the need and limits of responsibilities of others in the lab and of the institution as a whole.

Instead, we found that the students identified with the postdocs' lack of power in the situation and could not get beyond this. While the faculty enthusiastically endorsed this case because of the clarity of the problem in terms of individual researchers and subtlety of the institutional issues, some of the students perceived the postdocs only as victims. One student wrote, "I feel for the student because his advisor or mentor should have been there to help in constructing and checking the figures." Another wrote, "In both cases, some fault should be found with the researcher in charge of the lab... Was he putting undo pressure on these students to publish?" Yet another said that the postdoc's problems "stem from his inadequate training."

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19 The case we used was a real case that occurred at Cal Tech. The case is outlined in an article, Roberts, L. "Misconduct: Caltech's Trial by Fire." *Science*, 20(September):1344-1347. 1991. The students were given a modified version of this reference that omitted some of the editorial comments found in the original article.

Our first attempt at pre-test/post-test analysis was to give students instructions for the post-test that were identical to those given for the pre-test. That is, for both the pre-test/post-test, we gave the following instructions: 1) Identify what you see as the ethical problems in this case. 2) Discuss what the individuals involved did right. 3) Discuss what the individuals involved could have done or should have done differently.

As we analyzed our failure to uncover a significant difference in the students' pre-test and post-test analysis, we speculated that boredom was a factor. Students approached the post-test problem with a "been there, done that" attitude. From their perspective, analyzing the same problem that they had analyzed 10 weeks prior was a waste of time. Our hunch was validated by consensus on the student evaluation forms that the content of the course was "easy to understand." Although they enjoyed the class, students did not perceive themselves as learning anything new.

We also realized that as much as the faculty wanted to see improvement in how students approached ethical problems at the end of the term, we also were interested to see whether students perceived any change in themselves. It seemed to us that part of learning ethics is the student's ability to bring to consciousness patterns of thinking through problems, whether adequate or flawed. The student's ability to perceive change in how he or she thought about an ethical problem was at least as important as any change that we perceived.

The post-test instructions used in the second year reflected the faculty's new understandings. Students were specifically asked NOT to repeat their initial analysis, but to evaluate the adequacy of their initial analysis. In addition, students were given the post-test as a 'final exam'. The post-test instructions read as follows:

> The purpose of this final exam is to help assess the influence this class has had on the way in which you analyze ethical problems in the practice of science.

The diagnostic test that you completed at the beginning of the term is attached.

1) Please review the case, the instructions you received at the beginning of the term and your responses.

2) Analyze your initial response. Describe how your thinking has changed. Be sure to discuss understandings or information that you have now that you didn't have at the beginning of the term.

This is your opportunity to consider how your thinking has changed. Please notice changes in HOW you think as well as any changes in WHAT you think. It may be that you reach the same conclusion now that you did in the beginning of the term, but that you think about the situation in a different way.

3) Please attach your diagnostic test to the final exam.

Please keep in mind that you are NOT being asked to repeat the assignment from the beginning of the term. You are being asked to analyze how you initially responded to that assignment.

The results of this post-test showed changes in student performance not seen on the previous post-test. The students' meta-analyses did include recognition of patterns and generalizations—all necessary components for performing systematic moral analysis. In addition, they were able to reflect on their earlier attempts on analysis:

- *"All in all there are more options available and more ramifications involved in this scenario than I had originally considered."*
- *"I think my original response to this scenario is too simplistic."*
- *"I think that my original inspection of the first perspective was too sophomoric."*
- *"In addition to the arguments previously offered I would add the 'would you want everyone to do this?' test."*

These students were clear that they had made gains through the course.

Section 6
Concluding Remarks

It is hard to find someone who would admit to being against ethics. But, it's equally hard to find faculty in academic departments of science and engineering who are willing to give up precious graduate time and credits for formal instruction in ethics.

A survey published in the March 1989 issue of the Council of Graduate Schools Communicator showed that more than one third of the 259 deans responding believed that their school's performance was "not very effective" or "not at all effective" in preparing graduate students to deal with ethical issues in their profession. "Overall, 40% report that their schools have no expectations about ethics in the curriculum; ... 56% of the most heavily funded universities have neither informal expectations nor written policies."[20]

Our experience was consistent with this study. We had strong support for the seminar at the Graduate Dean level. We had strong interest by a handful of faculty across disciplines. We had students eager to engage in discussions concerning matters of ethics in research. But, when it came down to scheduling students to take a term-long, two-hour-per-week seminar, most faculty, even faculty for the course itself, didn't encourage their students to sign up, saying that they could not justify the time and energy that the course was perceived to take away from the students' "main graduate school mission". The students were unwilling to commit to the course without their mentors' support. And the Graduate Dean could only suggest, not demand, that departments recommend the course.

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20 Swazey, J. P., Seashore Louis, K. and Anderson, M. S. "University Policies and Ethical Issues in Research and Graduate Education: Highlights of the CGS Deans' Survey." *CGS Communicator*. XXII(3):1-3, 7-8. 1989.

Federal mandates that students on training grants be taught ethics encourages schools to do *something*, but that something is far more likely to resemble a two-hour session in platitudes and warnings or a lecture course in the conventions of science, than a 20-hour course that includes formalized training in ethics. Discussions with teachers of ethics in science at other centers indicates that many use perks (or bribes), such as serving lunch to students, to induce them to take ethics seminars. Such perks may help increase student attendance, but they will not help students become serious about the importance of studying ethics.

In some disciplines, such as medicine, the study of ethics has gained in importance in recent decades. Although an initial reason for this was probably an increase in litigation, the desire for education in medical ethics has taken on increased importance in the minds of many students and practitioners. Formal training in clinical ethics is now the rule rather than the exception in medical education. Ethics committees are now standard in most hospitals. Forums for discussion of ethical problems are common in medical settings. This type of interest in ethics will only occur in science if and when faculty become serious about the subject. It will only occur when faculty see the training of their students in ethics as an important part of their responsibility as mentors rather than as a threat to their security as authority figures. Finally, ethics will only become a standard part of graduate education when it becomes an established part of the graduate school curriculum. We hope that this will occur at most institutions before the numbers of misconduct cases makes it a federally mandated necessity.

Course Reading List

The following is the reading list which we used during the 1995 offering of our Ethics and Scientific Research course. Many of the articles cited can be found in the Coursebook which accompanies this monograph. The Coursebook also contains case scenarios of the type referred to in this reading list.

Week 1: Ethics: A Framework For Dealing With Ethical Problems In Research

Required Readings:

1. Gert, B. "Morality and Scientific Research." Personal communication.

Week 2: Methodology and Reporting

Required Readings:

1. Racker, E. "A View Of Misconduct In Science." *Nature* 339: 91-93. 1989.
2. Hilts, P. J. "The Science Mob." *The New Republic*.(May 18):25, 28-31. 1992.
3. Hamilton, D. P. "Verdict In Sight In 'The Baltimore Case'." *Science*. 251:1168-1172. 1991.

Week 3: Interpersonal Relationships

Required Readings:

1. Martin, R. G. *A Stampede of Zebras*. Washington, DC. 1991.

Week 4: Practical Applications in Reporting and Peer Review

Required Readings:

1. Committee on Science, Engineering and Public Policy. On Being a Scientist: Responsible Conduct in Research. Second Edition. National Academy Press. Washington, DC. 1995. Selected readings.
2. Bulger, R. E., Heitman, E., and Reiser, S. J. The Ethical Dimensions of the Biological Sciences. Cambridge University Press: Cambridge, MA. Selected readings.
3. "Ethical Guidelines for Publications of Research". *Endocrinology* 132:1-2. 1993.
4. Case scenarios.
5. Amato, I. "Rustum, Roy: PR is a Better System than Peer Review." *Science* 258: 736. 1992.

Suggested Readings:

1. McCutchen, C. W. "Peer Review: Treacherous Servant, Disastrous Master." *Technology Review* (October):27-40, 1991.

Week 5: Institutional Responsibility

Required Readings:

1. Taubes, G. "Misconduct: Views From the Trenches." *Science* Vol. 261:1108-11. 1993.

Week 6: Scientists Relationship with Funding Sources

Required Readings:

1. US Department of Health & Human Services. *Office of Research Integrity Biennual Report 1991-92.* Public Health Service. Rockville, MD. (September). 1993.

Suggested Readings:

1. "Chapter 1: Introduction." In *Responsible Science: Ensuring the Integrity of the Research Process.* Panel on Scientific Responsibility and the Conduct of Research. pp. 22-31. National Academy Press: Washington DC. 1993.
2. "How Many Shades of Grey." University of Illinois Board of Trustees. pp. 4.13-4.16. 1992.

Week 7: Ethics in Animal Experimentation

Required Readings:

1. Bennett, B. T. "Chapter 1: Regulations and Requirements." In *Essentials for Animal Research: A Primer for Research Personnel.* pp. 1-7. National Agriculture Library. 1994.
2. Tannenbaum, J. and Rowan, A. "Rethinking the Morality of Animal Research." *Hastings Center Report.* 15(5):32-43. 1985.
3. *Dartmouth College Animal Care and Use Policy.* Personal communication.
4. *Dartmouth College Animal Subject Review Form.* Personal communication.
5. Case Scenarios.

Suggested Readings:

1. Vance, R. P. "An Introduction to the Philosophical Presuppositions of the Animal Liberation/Rights Movement." *Journal of the American Medical Association.* 268:1715-1719.
2. Remfry, J. "Ethical Aspects of Animal Experimentation." In *Laboratory Animals: An Introduction for New Experimenters.* Tuffery, A. A. (ed.) pp. 5-21. 1987.

3. Caplan, A. L. "Beastly Conduct: Ethical Issues in Animal Experimentation." *Annals New York Academy of Sciences.* 406:159-169. 1983.

Week 8: Human Experimentation

Required Readings:

1. "The Nuremberg Code." *Trials of War Criminals Before the Nuremberg Military Tribunals Under Control Council Law.* 10(2):181-182. Washington DC. U. S. Government Printing Office. 1949.
2 US Dept. of Health and Human Services. "World Medical Association Declaration of Helsinki." In Protecting Human Subjects: Institutional Review Board Guidebook. (Appendix):A6-3 to A6-6. OPRR/NIH. Washington, DC. 1993.
3. Department of Health, Education, and Welfare.

"The Belmont Report: Ethical principles and guidelines for the protection of human subjects of research." *OPRR Reports.* (April 18). US Government Printing Office. Washington, DC. 1979.

4. Case scenarios.

Ethical Issues in Scientific Research

Bibliography and Videography

Notes on the Bibliography and Videography

A wealth of books, articles, and videos are available for use in research ethics courses. References to the materials collected during development of our course in research ethics and the companion NSF grant can be found in the Bibliographies and Videography presented in the following pages. The references provide a basis for incorporation of a rich variety of material into a research ethics course. When used along with the reader which accompanies this monograph they provide the resources for further study on important cases and topic areas of interest. They also provide material for lively class discussion.

The bibliography is divided into three sections a Case Bibliography, a Topic Bibliography and an Author Index. The divisions can help readers locate material of interest for particular class sessions or can enable readers to search for material of known authors. Some of the articles, cases, and books span several different topic areas. Nevertheless, to avoid duplication each article is cited in only one section of the Case or Topic Bibliography. Those publications that incorporate more than a singe topic area can be found in the General section of the Topic Bibliography.

The case bibliography presents lists of references on several of the more celebrated cases in research ethics. These cases encompass a number of different scientific disciplines and can be used to develop class sessions on a variety of different topic areas. Many of these cases are discussed and/or presented for consideration in abbreviated form in the Coursebook which accompanies this monograph. Material in the Case Bibliography can be used to supplement and extend a teacher's or student's understanding of the cases discussed in class.

The Challenger Case is a complex case in engineering ethics which brings to the fore many issues concerning conflicts of interest and commitment. It is presented and discussed in Chapter VI of the Coursebook. The Cold Fusion case is a

case in the physical sciences which helps to develop issues in reporting of research and peer review. The Gallo case is a case in the biomedical sciences that brings up questions of interpersonal interactions and misappropriation of intellectual property. This case is used to introduce the topic of interpersonal interactions in Chapter IV of the Coursebook. The cases in the Bibliography on the Human Radiation Experiments provide illustrations of human experimentation protocols gone awry. An article which depicts differing perspectives on some of these experiments is presented for discussion in Chapter IX of the Coursebook. One of the more complicated cases in research ethics, the Imanishi-Kari/Baltimore case provides material for discussion of fabrication of research results, interpersonal interactions, institutional responsibility, and whistleblowing. This extraordinarily complex case concerns the alleged fabrication of research results in an immunology laboratory. Two of the references in the Bibliography on this case are presented in Chapter III of the Coursebook where they can be used to illustrate many of the topics expounded upon in the rest of that volume. The Milgram case is a case in psychological experimentation using human subjects. It is discussed briefly in the chapter on Human Experimentation, Chapter IX of the Coursebook.

The final section of the Case Bibliography, Other Cases, contains a number of references to additional interesting, and often complex, cases. Many of these references are concise, well written articles that can provide valuable examples for class discussion. Several of the cases, including Robert's article on the CalTech case (1991), Marshall's article on the Michigan State project (1991) and, Amato's article on Rustum Roy's decision to forgo peer review (1992), can be found as part of the accompanying Coursebook.

The Topic Bibliography is divided into sections which reflect our course outline. These topics include Methodology, Reporting, Funding and Peer Review, Institutional Responsibility, Whistleblowing, Animal Experimentation, and

Human Experimentation. Added to that list are two important topic areas which, though not in our original course, were covered by the NSF consortium. These topics are Teaching and Learning and Conflict of Interest. We have also included a bibliography on Engineering ethics which should be particularly helpful to some audiences.

The General section of the Topic Bibliography includes material that does not fit neatly into any of the other case or topic areas. Included in this section are books of case scenarios such as the book by Koreman produced by the American Association of Medical Colleges and the book by R. L. Penslar of Indiana University. Also included are a novel by Carl Djerassi and a play by R. G. Martin. The play, *A Stampede of Zebras* provides an excellent source of material for class discussion of issues related to interpersonal interaction. This play is soon to be released as a video and as such is listed as well in the video index. Other books and articles present commentary, reviews, and case material.

Videos make an excellent contribution to a research ethics course. The Videography provides a list of videos that can be used to spark discussion and illustrate issues. The Videography presents videos along with a short description about the content of each. We also provide information on current prices and locations for purchase of the videos although we caution that this information is subject to change.

The Author Index is provided to assist those readers who may wish to locate a publication by author rather than topic. This bibliography contains the first author's name, year of publication, and the section in which the material can be found.

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A Series of Teaching Resources
In Applied and Professional Ethics

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The Institute for the Study of Applied and Professional Ethics at Dartmouth College
Hanover, New Hampshire

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ETHICAL ISSUES IN SCIENTIFIC RESEARCH: EVALUATION OF FACULTY DEVELOPMENT

Systematic reflection on the issues of ethics in scientific research is a relatively new feature of university life. Like other new developments, it is sometimes met with resistance. Many academic scientists regard such reflection as unnecessary, believing that scientists are able to conduct themselves ethically without discussion of the issues of science ethics, and without training or the assistance of non-scientists and philosophers. In evaluating this project, a key question was how well it succeeded in changing these attitudes among scientist participants and in eliciting their commitment to ethics training as a necessary part of the research enterprise. Also of interest was the impact on non-scientist participants of this close collaboration in the discussion and teaching of these issues with active scientific researchers.

Methodology:

Faculty development within this project had three distinct components: (1) the University Seminar offered in the fall of 1991 and, again, in the fall of 1992; (2) the preparation of core faculty to teach the course in the academic year 1992-93; and (3) actual teaching of the course in the winter of 1994 and, again, in the winter of 1995. To assess the impact on faculty of each of these activities, questionnaires were distributed to participants at the close of the first three weeks of the university seminar and at the close of the first year's offering of the seminar. Questionnaires were also distributed to core faculty following each offering of the course. (See the Appendix for these questionnaires). In addition, in my role as evaluator, I conducted individual and group interviews with core faculty to follow up on their

questionnaire responses. The following comments represent a synopsis and evaluation of these written and oral responses.

The University Seminar.

There was wide agreement among participants that the university seminar provided a novel and useful campus-wide forum to identify, discuss, and focus on issues and topics appropriate to the area of science research ethics. Strong emphasis was placed by many participants on the way in which the seminar permitted faculty from a variety of disciplines to become familiar with others' points of view and to offer presentations drawing on their respective areas of disciplinary expertise. Above all, the seminar introduced scientists and ethicists to one another and allowed direct engagement with the issues of scientific research ethics in an interdisciplinary way.

Participants registered a number of specific gains resulting from this conversation. Those with a background in ethics and moral philosophy found that they used this opportunity to dispel some basic misconceptions that impede responsible ethical analysis. Foremost among these was the misconception that good intentions alone make wrongful conduct right. They reported that this misconception frequently appeared in justifications of such behavior as grants of first authorship to individuals who clearly did not perform that role. Science participants report that they were able to bring to these discussions familiarity with research practices and expectations in a wide variety of scientific disciplines.

One immediate result of these seminars was an identification of issues and topics that were of special interest to the seminar participants and that needed more attention. These included the scope of research ethics, professional honesty

(especially when in tension with "career advancement"), mentor-student relationships, and practices related to attribution of credit. It also became clear in the course of the seminar that there was a need for more emphasis on cases or issues arising from the physical (as opposed to biomedical) sciences. Participants generally appreciated the case method that was used throughout the seminar, but they also expressed a need for more direct attention to ethical theory. Special value was found in the summary ethical conclusions at the close of each seminar. On balance, it can be said that the development of an appreciation among all participants of the need for and usefulness of ethical theory was one major achievement of the seminar.

Core faculty preparation

This aspect of faculty development had two components. The first was an ongoing tutorial on moral theory with the following major aims relevant to science faculty:

- To render all faculty conversant with the language of ethics;
- To make possible the systematic analysis of moral intuitions;
- To provide the language and conceptual tools needed to identify and think well about ethical issues/problems;
- To communicate how and where moral problems arise; and
- To prepare non-ethicists for teaching in this area.

In pursuing these goals, core faculty report that a special effort was made to prepare science participants to play an active role in teaching the ethical aspects of the course. Participants recognized that it is one thing to learn the language of ethics and another thing to teach it. As a result, a constant level of attention was given to pedagogical matters.

A second aspect of core faculty preparation was the effort made to familiarize ethicists and others with cases, issues, and the conventions of science. Among these were the question of under what conditions a researcher must report outlier data; when negative results should be reported, and so on. Understanding conventions provided ethicist participants with background information about accepted practices and problem areas.

As this preparatory process went forth, faculty report that they learned a variety of important lessons. The ethicists noted that there is a distinction between the way research is performed, which seems largely a scientific matter, and the ways in which it is reported, which involves both scientific and moral considerations. Some of the most troubling ethical problems cropped up at this reporting level. The ethicists also report becoming aware that science is a more corporate enterprise than they had thought, marked by considerable respect for authority. They learned that there are many more temptations for scientists to engage in unethical practice than they had believed. This evaluator was consistently surprised by the extent to which the non-science participants, as a result of their close involvement with this project, reported what can only be called increased cynicism about the ethical conduct of science and about the motives of scientists.

On their side, the scientists report having learned that ethics involves more than having an opinion. They came to see it as involving a rigorous method of reasoning, which, like science, approaches a complex case for decision by seeking to move from fragmentary information to a more comprehensive and consistent picture. Very importantly, the scientists report learning that a sense of method could help organize reasoned discussion without foreclosing reasonable differences of

opinion. This was in marked contrast to the view that ethical matters are either right, wrong, or, when disagreement occurs, "merely the result of one's opinion." In this connection, one scientist commented: "To me the beauty in the structured approach to ethics is not found specifically in its helpfulness in delineating "right" from "wrong" answers. The beauty is that a structured approach may help us realize that there are a number of morally permitted approaches."

Scientists report becoming aware, as well, that significant differences characterize the different scientific disciplines in method and approach to scientific and ethical issues. One of the surprising but consistent observations of the science core faculty was their surprise in learning that much more ethically questionable scientific behavior was going on than they initially thought. This was especially true in the areas of authorship and peer review of papers. It may be that the scientists' surprise in learning of these ethically questionable practices contributed to the increased levels of suspicion (and even cynicism) voiced by the ethicist participants.

Teaching the Course

Although resistance on the part of scientists to systematic reflection about ethics did not appear to be a major problem in the period of preparation leading up to the course, it reemerged in various ways when the course was taught. During the first offering, core faculty report encountering a series of obstacles and challenges that made it difficult for scientists and science graduate students to learn about and become comfortable using moral theory. Among these obstacles, the following seemed to stand out:

- A belief that ethical questions are simple, that there are few ethical dilemmas, and that wrongdoing is largely the result of bad people ("To avoid problems, just get rid of the bad apples.")
- A conviction that because science is the search for truth, most scientists are people of integrity and are not subject to wrongdoing.
- A belief that the proper conduct of science requires ethical integrity with the result that there is no "separate domain" of ethics apart from the maintenance of good scientific procedures.
- A penchant for objectivity, provability, falsifiability (what one ethicist called their "desperate hold on empiricism."). Ethics is regarded as "messy" and "soft."

It is a solid measure of overall faculty development that the faculty themselves, whether scientists or ethicists, came to disagree with these widely shared perceptions and beliefs. Thus, all faculty came to see as "complex," cases that students tended to judge as "simple." One science faculty member comments: "It is harder than I thought to deal with issues of scientific integrity with scientists. They tend to get defensive, feisty, and see ethics teaching as a peripheral activity."

Since the course was offered twice, there was an opportunity to apply lessons from the first offering of the course to the second. Following the first offering of the course, core faculty concluded that the lecture format was not very effective for this kind of inquiry. In the first offering of the course, they assert, too little emphasis was placed on cases and there was a shortage of cases to spark the interest of the engineers who then constituted most of the students. Correcting this problem, in the second offering much more emphasis was placed on case studies. In the words of one core teacher, "The Baltimore case in particular is an inexhaustible source of

ethical transgressions and human foibles related to biomedical sciences." A consistent effort was also made to tie the discussion as closely as possible to any preceding ethics lectures. Finally, students were asked to develop 3-4 cases, each, and present them. This sensitized students to the need for identifying characters, issues and complexity in ethics cases.

If core teachers emerged from the second year of the course with a better sense of appropriate pedagogy in this area, they were reinforced in their sense that science faculty generally are neutral to negative about the issue of science research ethics and don't sufficiently encourage students to participate in training in this area. One teacher comments that "Unless there is an 'ethics ethic' at the institution, research ethics discussions are not taken very seriously." It was my perception that the core faculty consistently received less support from scientist colleagues in promoting this course among the pool of available graduate students than the teaching faculty would have liked.

Conclusion

It was observed at the outset that resistance to systematic reflection and training in science research ethics is to be expected because of the novelty and challenge of these issues. Although this problem did not arise among university seminar participants—who, after all, had self-selected to engage in this inquiry—it manifested itself in various ways when the course was taught. Significantly, it appears that, at least for the teaching faculty involved, the result of this project was to help them develop, in addition to considerable sophistication about the issues of scientific research ethics and the challenges of teaching in this area, a deep commitment to the value of this activity. At the close of the project, the ethicists

and scientists involved as core teachers had not only arrived at substantial agreement about the way that science research ethics education should be structured and conducted, but they were also in far more agreement about the need for education in this area than were many of their students and their non-involved science colleagues.

It can be said, of course, that this consensus was a result of pre-selection, since only those scientists committed to the need for reflection and training in this area participated in the development and offering of this course. Running counter to this conclusion, however, is the evidence gleaned from questionnaires and interviews that the science participants only arrived at an enhanced appreciation of the need for such reflection and training as a result of their participation in the university seminar, course development, and repeated offerings of the course. This suggests that one of the very best ways of developing science faculty appreciation and understanding of science research ethics is to actively involve them in the teaching of these issues. Not only is the involvement of scientists crucial to multidisciplinary work of this kind, it turns out to be a powerful educational method in its own right.

Submitted by:

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